Phase II Environmental Site Assessment

Hannover Property /
Lot 2/B ofFormer AM General/
LTV Missiles and Aerospace Facility
731 West Chippewa Avenue
South Bend, Indiana 46614

Prepared for:

The City of South Bend, Indiana Land Trust 731 GRN and the Indiana Finance Authority - Indiana Brownfields Program

Submitted by:

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Executive Summary

This Phase II Environmental Site Assessment (ESA) report was prepared for the City of South Bend (City) and Indiana Land Trust 731 GRN (ILT) to evaluate subsurface soil and groundwater impacts within and throughout the surrounding area of the parcel commonly known as the Hannover Property, located at 731 West Chippewa Avenue in South Bend, Indiana. The assessment area consisted of 15.3 acres of land containing five buildings, three pump houses, a storage shed and an abandoned water tower that were originally used for storage and building maintenance for the AM General/LTV Aerospace and Missiles Facility located adjoining the subject property to the west. This Phase II ESA included the assessment of the subject property, as well as the sampling of the groundwater monitoring well network located on the subject site and located within the immediately adjacent properties. This Phase II ESA was performed under a 2007 Indiana Finance Authority (IFA) Brownfields Site Assessment Grant Incentive (SAGI) award provided to the City on the behalf of ILT. This document has been prepared for the use of the City, ILT, the Indiana Brownfields Program (IBP) and the Indiana Department of Environmental Management (IDEM). A site location map is provided as Figure 1.

Quality Environmental Professionals, Inc. (Qepi) has performed a subsurface soil and groundwater investigation at the Hannover Property located at 731 West Chippewa Avenue in South Bend, Indiana. This investigation consisted of the advancement of 40 soil borings throughout the site, the installation of eight deep aquifer groundwater monitoring wells along the northern boundary of the site and the sampling of the existing well network located at the site and the surrounding properties. The investigation also consisted of the installation of 9 shallow groundwater monitoring wells converted from the soil borings. The investigation revealed the following:

- 9 of the 40 soil borings advanced exhibited concentrations exceeding IDEM Risk Integrated System of Closure (RISC) Default Residential Default Cleanup Levels (RDCLs) for tetrachloroethene (PCE) from depths ranging from 0 feet below ground surface (bgs) to 4 feet bgs. Additionally, 1 of the 40 soil borings exhibited PCE concentrations exceeding IDEM RISC RDCLs from a depth of 10 to 12 feet bgs. Concentrations of PCE exceeding IDEM RISC Industrial Default Cleanup Levels (IDCLs) were not encountered in the soil borings advanced.

  In addition to PCE impacts, 3 of the 40 soil borings advanced exhibited concentrations exceeding IDEM RISC RDCLs for trichloroethene (TCE) from depths ranging from 0 feet bgs to 6 feet bgs. Concentrations of TCE exceeded IDEM RISC IDCLs were not encountered in the soil borings advanced. These impacts were encountered primarily in borings advanced in the southern and central portion of the property.

- 1 of the 40 soil borings advanced exhibited concentrations exceeding IDEM RISC IDCLs for total petroleum hydrocarbon (TPH) extended range organics (ERO) from a depth of 0 to 2 feet bgs. Additionally, 8 of the 40 soil borings exceeded IDEM RISC RDCLs at varying depths.

- 5 of the 40 soil borings advanced exhibited concentrations exceeding IDEM RISC IDCLs for arsenic from a depth of 2 to 4 feet bgs. Additionally, 1 soil boring advanced exhibited concentrations exceeding IDEM RISC IDCLs for cadmium from a depth of 2 to 4 feet bgs. One soil boring exhibited concentrations exceeding IDEM RISC IDCLs for lead from a depth of 2 to 4 feet bgs.

- Three of the 29 groundwater samples collected from the soil borings advanced exhibited concentrations exceeding IDEM RISC IDCLs for PCE. Additionally, 2 of the 24 groundwater samples collected exhibited concentrations exceeding IDEM RISC IDCLs for TCE. One of the 29 groundwater samples collected from the soil borings exceeded IDEM RISC IDCLs for TPH (ERO).

- Of the 53 existing and newly installed groundwater monitoring wells sampled as part of this investigation, chemical concentrations exceeding IDEM RISC IDCLs were exhibited in 1 monitoring well for PCE; 1 monitoring well for vinyl chloride (VC); 6 monitoring wells for TPH gasoline range organics (GRO); 14 monitoring wells for TPH (ERO); 6 monitoring wells for benzene; 5 monitoring wells for arsenic and 4 monitoring wells for lead. In addition to these impacts, 3 monitoring wells exhibited impacts exceeding IDEM RISC IDCLs for 2-Methylnapthalene.

  These impacts were primarily encountered in groundwater monitoring wells installed and located in the northern and northwestern portion of the subject site and the existing monitoring wells located directly north and northwest of the subject site.

- Of the 53 existing and newly installed groundwater monitoring wells sampled, free petroleum light non-aqueous phase liquids (LNAPLs) product was encountered in 7 monitoring wells ranging from 0.01 feet to 2.38 feet in thickness.

- Chemical concentrations were not detected exceeding IDEM RISC RDCLs or IDCLs for any of the eight deep groundwater monitoring wells installed during this investigation.

Based on the results of this subsurface investigation and a review of previously collected data, it appears impacted soils do not represent a potential source of chemical impacts to groundwater at the site and the surrounding properties. Elevated impacts of TPH (GRO/ERO) are located in groundwater monitoring wells throughout the northern and northwestern portion of the subject site along with elevated impacts in groundwater wells located north and northwest of the subject site on the Mother Earth, LLC property and the AM General parcel. Free product petroleum LNAPLs were encountered in seven of these groundwater monitoring wells. These results indicate the presence of significant free petroleum product atop the first encountered groundwater unit in this area of the subject site.

1.0 Introduction

Qepi was contracted by the City of South Bend to conduct a Phase II ESA at the parcel commonly known as the Hannover Property located at 731 West Chippewa Avenue in South Bend, Indiana, herein referred to as the "site." Qepi understands that the property is in the process of redevelopment, and therefore the City, on behalf of the ILT, has requested this investigation. This document has been prepared for the use of the City, ILT, the IBP and IDEM.

This assessment was conducted for the purpose of evaluating and delineating subsurface soil and groundwater impacts throughout the site. A site map depicting the investigation area of the subject site is provided as Figure 2.

In addition to the subsurface evaluation and delineation of impacts within the subject site, Qepi was tasked by the IBP and IDEM to evaluate groundwater impacts on the properties adjacent to the subject site and correlate adjacent site chemical concerns to the subject site. Prior investigation conducted at the three adjacent sites determined chemical impacts were present to both soil and groundwater at these sites along the border of the subject site and these properties. Numerous groundwater monitoring wells, previously installed during these prior subsurface investigations, are present within and around the subject site. As part of this assessment, Qepi, in coordination with IDEM personnel, sampled each of the previously existing monitoring wells at and around the subject site. Groundwater monitoring well sampling results are to be used in connection with this subject site assessment to determine the extent of impacts to soil and groundwater and utilized to evaluate remedial alternatives for the subject site and immediately adjacent area. A site map depicting the entire investigation area, including the subject site and immediately adjacent area, is provided as Figure 3.

Based on the historic use of the site and under the direction of the IBP and IDEM, the prospective chemicals of concern (COCs) included in this investigation are total petroleum hydrocarbons (TPH) gasoline range organics (GRO) and extended range organics (ERO), volatile organic compounds (VOCs) and Resource, Conservation and Recovery Act (RCRA) metals. Based on a review of previously collected data, select samples collected were additionally analyzed for semi-volatile organic compounds (SVOCs), carcinogenic polynuclear aromatic hydrocarbons (cPAHs) and polychlorinated biphenyls (PCBs).

Qepi advanced a total of 40 soil borings to a maximum of depth of 28 feet bgs. Two soil samples from each soil boring advanced were submitted for laboratory analysis of TPH (GRO/ERO) and VOCs. The initial encountered soil sample interval from each soil boring was additionally sampled for RCRA metals. Twenty-one of the 40 samples collected were also submitted for laboratory analysis of cPAHs and five of the 40 samples collected were submitted for laboratory analysis of PCBs. The first soil sample collected from each soil boring was collected from the initial subsurface interval below any concrete or building construction material. The second soil sample collected was collected from the depth encountered immediately above the first encountered saturated zone.

In addition to soil samples collected, groundwater samples were collected from 29 of the soil borings advanced. Groundwater samples collected were submitted for laboratory analysis of TPH

(GRO/ERO) and VOCs. Ten of the soil borings advanced were additionally sampled for cPAHs and two were sampled for PCBs. Of the 40 soil borings advanced, nine were converted into groundwater monitoring wells. These nine groundwater monitoring wells were sampled for TPH (GRO/ERO), VOCs, cPAHs and RCRA Metals. Soil boring and monitoring well locations are depicted on Figure 4.

Along with the onsite subsurface investigation, Qepi redeveloped and sampled 38 groundwater monitoring wells and 6 groundwater monitoring points installed within the subject site and around the immediately adjacent properties. In coordination with IDEM staff, Qepi personnel mapped and surveyed each of the existing monitoring wells and points. Qepi personnel assessed each well to determine if the wells were usable. After assessment, Qepi personnel redeveloped wells as necessary and subsequently sampled each of the existing wells for TPH (GRO/ERO), VOCs, SVOCs and RCRA Metals.

In addition to the existing well network sampling, Qepi personnel provided oversight for the advancement of eight additional soil borings to a maximum depth of 96 feet bgs. These soil borings were conducted to evaluate to presence of deep impacts to soil and groundwater along the northern boundary of the subject site and adjacent property to the west. These soil borings were completed as groundwater monitoring wells. These deep groundwater monitoring wells were sampled for TPH (GRO/ERO) and VOCs. A site map depicting existing monitoring well locations and newly installed deep monitoring wells is provided as Figure 5.

The purpose of this subsurface investigation was to determine the extent of impacts to groundwater throughout the subject site and to delineate known impacts in existing groundwater monitoring wells on and surrounding the subject site. This investigation will further be utilized to aide the ILT, IDEM and the IBP in evaluating remedial alternatives for the site and immediately surrounding properties. This investigation was limited to the COCs, sample depths and areas sampled. Qepi was provided with previously completed Phase I Environmental Site Assessments as well as previously completed limited Phase II Site Assessments, limited subsurface investigations and other analytical data sets collected by IDEM and other consultants to help aid in this investigation. Reviews of these reports were completed and are summarized throughout this report. Reports reviewed are referenced in Section 6.0 of this report.

2.0 Physical Description

2.1 Site Description

The subject property is located at 731 West Chippewa Avenue in South Bend, Indiana. The site is roughly triangular in shape and bounded to the south by fencing and the driveway of the AM General facility, to the west by the drive way of the AM General facility, to the east by fencing and a rail line and to the north by fencing and the former Studebaker Plant 8 facility. The site is located directly south of downtown South Bend, Indiana. The subject property is located in the northeast quarter of Section 23, Township 37 North, and Range 2 East in Saint Joseph County, Indiana. The site is represented on Figure 1 on the United States Geological Survey (USGS) 7.5 Minute Topographic Map of the South Bend West, Indiana Quadrangle.

The subject property consists of five main buildings, three pump houses, a storage shed with associated storage bays and an abandoned water tower with associated parking lot, staging and landscaped areas on 15.3 acres. The buildings occupy approximately 57,500 square feet of space. The site is roughly triangular in shape, with dimensions of approximately 1,400 feet north to south along western boundary by approximately 600 feet east to west along the northern boundary by approximately 1,500 feet northeast to southwest along the eastern boundary. The structures are present within the central and eastern portions of the site. An asphalt and concrete parking lot is present along the western boundary of the site. The abandoned water tower is located in the western portion of the site. A large staging area containing piles of concrete and other construction debris is located in the northeastern and eastern portion of the site. An abandoned railroad line extends northeast to southwest along the eastern boundary of the site. Landscaped and areas of overgrowth vegetation are located surrounding the railroad corridor. The site can be accessed via one paved entrance into the southern portion of the site off of the main drive into the Studebaker Commerce Center parking lot, off of West Chippewa Avenue.

2.2 Physical Setting

According to the USGS topographic map, the topography of the site is relatively flat with an elevation of approximately 770 feet above mean sea level (amsl). The site is located in the Kankakee Outwash and Lacustrine Plain Physiographic Region. The site is located in the St. Joseph River Basin (INDNR, 1987). The area is characterized by alluvium, glacial outwash, and terraces. Surficial deposits are predominately sand and gravel. Most of the surficial material was deposited during the late Wisconsin Glaciation.

The predominate soil types in the project site area are Tyner-Oshtemo association soils consisting of deep, nearly level to strongly sloping, well drained and coarse textured and moderately coarse textured soils. These soils are developed on outwash plains and terraces (Benton, 1977). The Tyner series found at the site consists of deep, well-drained soils formed in sandy outwash. Permeability is rapid and has a low available water capacity. Organic matter content is moderate in the surface layer. Runoff is slow or medium. Slope ranges from 0 to 6 percent (Benton, 1977). Unconsolidated deposits in the vicinity of the subject site are approximately 150 feet thick (Gray, 1983).

Underlying bedrock is the Devonian Ellsworth Group (Gray, Ault, and Keller, 1987). The lower part of the Ellsworth Shale consists of alternating beds of gray-green shale and brownish-black shale. The upper part of the Ellsworth is grayish-green shale with light-greenish limestone or dolomite lenses. In some places, it contains a dark-gray, thinly laminated dolomite. (Shaver, et al, 1986). The bedrock surface underlying the site slopes to the southwest (Gray, 1982).

Based upon area topography, surface drainage in the area of the Hannover Property is northwest towards Bowman Creek. The well network corridor surrounds Bowman Creek, to which direction each of the adjacent parcel's surface drainage flows. Regional groundwater flow direction in the area of the site is most likely northeast towards the St. Joseph River (Beaty and Clendenon, 1987).

3.1 On Site Investigation

3.1.1 Sampling Methodology

A total of 40 soil borings (B-1 through B-40) were advanced to a maximum depth of 28 feet bgs at the site from June 19 to June 26, 2008. All borings were advanced using direct push technology and logged on Qepi boring logs. Boring logs are provided as Appendix A. Drilling activities were conducted by Midway Services, Inc. of Knightstown, Indiana under oversight by Qepi personnel.

Soil was logged in 2-foot intervals and screened with a photo-ionization detector (PID). Both the 2-foot interval at the initial soil surface and the 2-foot interval immediately above the first encountered saturated zone were submitted to Envision Laboratories, Inc. of Indianapolis, Indiana for laboratory analysis using United States Environmental Protection Agency (USEPA) SW-846 Method 8015 for TPH (GRO/ERO) and USEPA SW-846 Method 8260 for VOCs. Soil samples collected from the initial encountered soil surface were also submitted for laboratory analysis of RCRA metals using USEPA SW-846 Method 6010B/7471A.

In addition to these samples, 20 of the soil borings were sampled from both intervals collected and submitted for laboratory analysis of cPAHs and five of the soil borings were sampled from both intervals collected and submitted for laboratory analysis of PCBs. Samples were submitted for laboratory analysis of cPAHs using USEPA SW-846 Method 8270 SIM and for PCBs using USEPA SW-846 Method 8082. It should be noted that samples collected for PCB analysis were located in the direct vicinity of the electrical substation located on the property.

In addition to the soil samples collected, groundwater samples were collected from 29 borings of the 40 soil borings advanced. Groundwater samples collected from each of the soil borings were submitted for laboratory analysis of TPH (GRO/ERO) and VOCs. In addition to these analyses, ten of the groundwater samples collected (B-9, B-16, B-20, B-21, B-28, B-30, B-31, B-33, B-34 and B-36) and two of the groundwater samples collected (B-10 and B-12) from the soil borings were submitted for laboratory analysis of cPAHs and PCBs, respectively.

Nine of the soil borings advanced (B-4, B-11, B-18, B-19, B-22, B-27, B-32, B-35 and B-40) were completed as groundwater monitoring wells QW-1 through QW-9. These groundwater monitoring wells were installed to a depth of 17 feet to 25 feet bgs and were constructed of PVC with 10 feet of 0.010-inch slotted screen with riser to the top of casing.

Each of the monitoring wells installed were subsequently developed utilized IDEM approved well development methodology. After allowing sufficient time to recharge, each groundwater monitoring well was sampled. Samples collected from each of the monitoring wells were submitted for laboratory analysis of TPH (GRO/ERO), VOCs, cPAHs and RCRA Metals using the above referenced laboratory analytical methods. All samples collected were placed into laboratory-

prepared sample containers, stored in a secured, iced cooler (at 4°C), and transported under Qepi's chain of custody protocol.

3.1.2 Soil Sample Results

3.1.2.a Volatile Organic Compounds

Soil impacts exceeding IDEM RISC IDCLs for TPH (ERO) was encountered in 1 soil boring (B-10) from a depth of 0 to 2 feet bgs. Additionally 7 soil borings (B-11, B-13, B-14, B-16, B-22, B-29, and B-30) were found to have impacts exceeding IDEM RISC RDCLs between 0 and 4 feet bgs and one soil boring (B-26) had impacts exceeding IDEM RISC RDCLs from 14 to 16 feet bgs for TPH (ERO).

Soil impacts exceeding IDEM RISC RDCLs for PCE were encountered in 9 soil borings (B-2, B-3, B-11, B-14, B-17, B-21, B-24, B-26, B-32) from depths of 0 to 4 feet bgs and in one boring (B-17) from a depth of 10 to 12 feet bgs. In addition, three soil borings (B-4, B-7 and B-22) exceeded IDEM RISC RDCLs for TCE. No additional VOC concentration exceeded IDEM RISC RDCLS or IDCLs. VOC analytical results are depicted on Figure Series 6 and shown on Table 1.

3.1.2.b Metals

Soil impacts exceeding IDEM RISC IDCLs for lead were encountered in one soil boring (B-31) from the initial encountered subsurface soil interval. Additionally, seven soil borings (B-10, B-11, B-13, B-25, B-29, B-33 and B-35) exhibited lead concentrations above IDEM RISC RDCLs from the initial encountered subsurface soil interval.

Soil impacts exceeding IDEM RISC IDCLs for arsenic were encountered in five soil borings (B-13, B-15, B-16, B-32 and B-37) from the initial encountered subsurface soil interval. Additionally, eight soil borings (B-2, B-14, B-19, B-20, B-29, B-33, B-35 and B-39) exhibited arsenic concentrations above IDEM RISC RDCLs from the initial encountered subsurface soil interval.

Soil borings B-10 and B-33 exhibited cadmium concentrations above the IDEM RISC RDCLs and the IDEM RISC IDCLs from the initial encountered subsurface soil interval, respectively. No other metal concentration encountered exceeded industrial cleanup objectives. RCRA metal analytical results are depicted on Figure Series 7 and shown on Table 2.

3.1.2.c Polychlorinated Biphenyls

Concentrations exceeding laboratory detection limits for PCBs were not encountered in any of the soil borings advanced. PCBs do not appear to be of concern in the area of investigation. PCB analytical results are summarized on Table 3.

3.1.2.d Carcinogenic Polynuclear Aromatic Hydrocarbons

Concentrations exceeding IDEM RISC RDCLs or IDCLs for cPAHs were not encountered in any of the soil borings advanced. CPAHs do not appear to be of concern in the area of investigation. CPAH analytical results are depicted on Figure Series 8 and summarized on Table 4.

3.1.3 Groundwater Sample Results

3.1.3.a Volatile Organic Compounds

Groundwater impacts exceeding IDEM RISC IDCLs for PCE were encountered in 3 soil borings (B-5, B-6 and B-24) and in one groundwater monitoring well installed (QW-2). In addition, 2 soil borings (B-6 and B-24) exhibited TCE impacts and 1 soil boring (B-30) exhibited TPH (ERO) impacts above IDEM RISC IDCLs. One of the groundwater monitoring wells installed (QW-7) exhibited impacts exceeding IDEM RISC IDCLs for TPH (GRO) and VC and two groundwater monitoring wells (QW-7 and QW-8) exhibited impacts exceeding IDEM RISC IDCLs for TPH (ERO).

VOC analytical results are depicted on Figure Series 9 and summarized on Table 5.

3.1.3.b Polychlorinated Biphenyls

Concentrations exceeding laboratory detection limits for PCBs were not encountered in any of the groundwater samples collected in either the soil borings or the monitoring wells. PCBs do not appear to be of concern in the area of investigation. PCB groundwater analytical results are shown on Table 6.

3.1.3.c Carcinogenic Polynuclear Aromatic Hydrocarbons

Groundwater impacts exceeding IDEM RISC RDCLs for naphthalene was encountered in one soil borings (B-30). No additional cPAH concentrations were encountered exceeding laboratory detection limits in the groundwater samples collected in either the soil borings or the monitoring wells. CPAH analytical results are depicted on Figure Series 10 and summarized on Table 7.

Onsite soil and groundwater laboratory analytical data reports are provided in Appendix B.

3.2 Additional Sampling and Well Installation Activities

3.2.1 Deep Monitoring Well Installation and Sampling

At the behest of IDEM, Qepi provided oversight for the advancement of 8 soil borings along the northern border of the Hannover subject site and the immediately adjacent property to the west from

June 30 to July 23, 2008. These soil borings were advanced to investigate the presence of potential deep subsurface impacts to both soil and groundwater and to evaluate the potential migration of deep groundwater impacts along this corridor. Soil borings were advanced to a maximum depth of 98 feet bgs. This maximum depth was determined based on the location of the first encountered groundwater aquitard unit. Borings were advanced using hollow stem augering combined with split spoon sampling methodology and continuously logged on Qepi boring logs. Deep soil boring logs are provided as Appendix C. Drilling activities were conducted by Earth Exploration, Inc. of South Bend, Indiana.

Soils were logged in 2-foot intervals and screened with a PID. Soil samples were not collected for laboratory analysis from these soil borings.

After the advancement of the soil borings, each boring was completed as groundwater monitoring wells DQW-1 through DQW-8. These groundwater monitoring wells were installed to a depth of 87 feet to 95 feet bgs and were constructed of PVC with 20 feet of 0.010-inch slotted screen with riser to the top of casing.

Each of the monitoring wells installed were subsequently developed utilized IDEM approved well development methodology, with a minimum of ten well volumes purged from each well prior to sampling. After allowing sufficient time to recharge, each groundwater monitoring well was sampled. Samples collected from each of the deep monitoring wells were submitted for laboratory analysis of TPH (GRO/ERO) and VOCs using USEPA SW-846 Method 8015 and USEPA SW-846 Method 8260, respectively. All samples collected were placed into laboratory-prepared sample containers, stored in a secured, iced cooler (at 4°C), and transported under Qepi's chain of custody protocol.

3.2.1.a Sample Results

Concentrations exceeding laboratory detection limits for TPH (GRO/ERO) or VOCs were not encountered in any of the deep groundwater monitoring wells. Migration of impacts to depth along this corridor does not appear to be of concern in the area of investigation. Deep groundwater monitoring well analytical results are summarized on Table 8. Deep monitoring well groundwater laboratory analytical data reports are provided in Appendix D.

3.2.2 Existing Monitoring Well Network Sampling

At the behest of IDEM, Qepi conducted evaluation and sampling of the groundwater monitoring well network located at the subject property and throughout the three properties adjoining the subject property to the north, northwest and west. Qepi coordinated with IDEM personnel prior to the sampling events to locate and identify each of the monitoring wells to be sampled. After locating each monitoring well, Qepi personnel visually inspected and gauged each groundwater monitoring well to determine well integrity. Several monitoring wells were redeveloped by Qepi personnel after

examination to ensure each well could be properly sampled. Well redevelopment activities were conducted under IDEM approved methodology, as previously described.

After well assessment and redevelopment, Qepi determined that of the existing 58 groundwater monitoring wells located on the three properties identified by IDEM, 44 of the groundwater monitoring wells remained intact and were suitable for sampling. From August 5, 2008 to August 12, 2008, Qepi personnel conducted sampling of these monitoring wells in concert with ongoing groundwater sampling. Samples collected from each of the monitoring wells were submitted for laboratory analysis of TPH (GRO/ERO) using USEPA SW-846 Method 8015, VOCs using USEPA SW-846 Method 8260, SVOCs using USEPA SW-846 Method 8270 and RCRA Metals using USEPA SW-846 Method 6010B. All samples collected were placed into laboratory-prepared sample containers, stored in a secured, iced cooler (at 4°C), and transported under Qepi's chain of custody protocol.

3.2.2.a Volatile Organic Compounds

Groundwater impacts exceeding IDEM RISC IDCLs for TPH (GRO) were encountered in 5 monitoring wells (GP-5, MW-325, MW-327, MW-329 and MW-330). In addition, 12 monitoring wells (GP-5, GP-13, GP-81, GMW-3, MW-320, MW-321, MW-323, MW-325, MW-327, MW-329, MW-330 and MW-332) exhibited TPH (ERO) impacts above IDEM RISC IDCLs. Six groundwater monitoring wells (GP-81, GMW-3, MW-327, MW-330, MW-332 and MW-333) exhibited benzene concentrations and one groundwater monitoring well (MW-333) exhibited a VC concentration exceeding IDEM RISC IDCLs. VOC analytical results are depicted on Figure Series 11 and summarized on Table 8.

3.2.2.b Metals

Groundwater impacts exceeding IDEM RISC IDCLs for lead were encountered in four monitoring wells (MW-302, GMW-2, GMW-5 and GP-6). Additionally, groundwater impacts exceeding IDEM RISC IDCLs for arsenic were encountered in five monitoring wells (MW-320, MW-327, MW-329, MW-330 and MW-333). Metals analytical results are depicted on Figure Series 12 and summarized on Table 9.

3.2.2.c Semi-volatile Organic Compounds

Groundwater impacts exceeding IDEM RISC IDCLs for 2-Methylnapthalene were encountered in 3 groundwater monitoring wells (MW-327, MW-329 and MW-333). No other SVOC concentrations were encountered exceeding IDEM RISC IDCLs. SVOC analytical results are depicted in Figure Series 13 and summarized on Table 10.

It should be noted that laboratory detection limits for several SVOC constituents, including bis (2-chloroethyl) ether, 3,3-dichlorobenzidene, n-Nitrosodi-n-propylamine and pentachlorophenol, were presented above current IDEM default closure criteria. After further review of these chemicals, Qepi

does not believe these constituents represent a concern for the subject site. Other instances were laboratory detection limits exceeded IDEM default closure criteria do not appear to warrant further review at this time.

Offsite monitoring well groundwater laboratory analytical data reports are provided in Appendix E.

3.2.3 Surveying and Groundwater Flow Determination

After the completion of the subsurface investigation and the installation of new monitoring wells, Qepi provided oversight for the surveying of the entire multi-property groundwater monitoring well network. Qepi retained Saylor Land Surveying, Inc. of Mill Creek, Indiana to conduct the surveying. Surveying of each monitoring well was completed to grade and included the collection of global positioning systems (GPS) points for each monitoring well location. Qepi utilized groundwater gauging data to calculate groundwater flow at the subject site and surrounding area. Based on gauging data collected from August 8 through August 12, 2008, groundwater flow was measured flowing roughly east to southeast for the main corridor shallow monitoring well network. The deeper well network located on the AM General Test Track facility had groundwater flow measured to the northwest. A map depicting groundwater flow is provided as Figure 14. A table documenting groundwater well surveying information is provided as Table 11. It should be noted that historical investigations throughout the subject corridor have concluded variable groundwater flow directions are present due to the proximity of the corridor to Bowman Creek and the City Municipal South Well Field, located directly southeast of the Hannover parcel.

3.3 Waste Disposal

During the course of well installation and sampling activities, all soil and purged groundwater wastes were collected and stored temporarily onsite in steel 55-gallon drums. From August 29, 2008 to September 3, 2008, all generated waste drums were collected from the site by Terraco, Inc. of Indianapolis, Indiana for disposal. A total of 53 soil drums and 36 purged groundwater drums were collected and disposed of as petroleum impacted wastes at CGS Services, Inc. of Morristown, Indiana. Soil and groundwater waste disposal manifests are provided as Appendix F.

4.0 Conclusions & Recommendations

Qepi has performed this subsurface investigation as outlined in the proposed scope of work at the Hannover Property, located at 731 West Chippewa Avenue in South Bend, Indiana. This assessment revealed the following results:

- 9 of the 40 soil borings advanced exhibited concentrations exceeding IDEM RISC RDCLs for PCE from depths ranging from 0 feet below ground surface (bgs) to 4 feet bgs. Additionally, 1 of the 40 soil borings exhibited PCE concentrations exceeding IDEM RISC RDCLs from a depth of 10 to 12 feet bgs. Concentrations of PCE exceeding IDEM RISC IDCLs were not encountered in the soil borings advanced.

  In addition to PCE impacts, 3 of the 40 soil borings advanced exhibited concentrations exceeding IDEM RISC RDCLs for TCE from depths ranging from 0 feet bgs to 6 feet bgs. Concentrations of TCE exceeded IDEM RISC IDCLs were not encountered in the soil borings advanced. These impacts were encountered primarily in borings advanced in the southern and central portion of the property.

- 1 of the 40 soil borings advanced exhibited concentrations exceeding IDEM RISC IDCLs for TPH ERO from a depth of 0 to 2 feet bgs. Additionally, 8 of the 40 soil borings exceeded IDEM RISC RDCLs at varying depths.

- 5 of the 40 soil borings advanced exhibited concentrations exceeding IDEM RISC IDCLs for arsenic from a depth of 2 to 4 feet bgs. Additionally, 1 soil boring advanced exhibited concentrations exceeding IDEM RISC IDCLs for cadmium from a depth of 2 to 4 feet bgs. One soil boring exhibited concentrations exceeding IDEM RISC IDCLs for lead from a depth of 2 to 4 feet bgs.

- Three of the 29 groundwater samples collected from the soil borings advanced exhibited concentrations exceeding IDEM RISC IDCLs for PCE. Additionally, 2 of the 24 groundwater samples collected exhibited concentrations exceeding IDEM RISC IDCLs for TCE. One of the 29 groundwater samples collected from the soil borings exceeded IDEM RISC IDCLs for TPH (ERO).

- Of the 53 existing and newly installed groundwater monitoring wells sampled as part of this investigation, chemical concentrations exceeding IDEM RISC IDCLs were exhibited in 1 monitoring well for PCE; 1 monitoring well for vinyl chloride (VC); 6 monitoring wells for TPH (GRO); 14 monitoring wells for TPH (ERO); 6 monitoring wells for benzene; 5 monitoring wells for arsenic and 4 monitoring wells for lead. In addition to these impacts, 3 monitoring wells exhibited impacts exceeding IDEM RISC IDCLs for 2-Methylnapthalene.

  These impacts were primarily encountered in groundwater monitoring wells installed and located in the northern and northwestern portion of the subject site and the existing monitoring wells located directly north and northwest of the subject site.

- Of the 53 existing and newly installed groundwater monitoring wells sampled, free petroleum LNAPLs product was encountered in 7 monitoring wells ranging from 0.01 feet to 2.38 feet in thickness.

- Chemical concentrations were not detected exceeding IDEM RISC RDCLs or IDCLs for any of the eight deep groundwater monitoring wells installed during this investigation.

The primary area impacted above IDEM RISC IDCLs appears to encompass the area in which the three immediately adjoining properties (Hannover, Mother Earth and AM General) border each other. This area, located in the northwestern most corner of the subject site, also appears to be the location of the highest concentration of free product located on the property. This area coincides with the location of two large underground storage tank farms, historically located at the subject site.

In addition to these petroleum impacts, chemical solvent impacts appear to be present throughout southern and central portion of the site. Chemical solvent impacts were not detected in significant enough concentrations to lead to the assumption that a source area of solvent impacts was encountered. Utilizing data collected from previously conducted investigations at the subject site and the AM General parcel to the west, chemical solvent impacts appear at both facilities in concentrations either exceeding or slightly below IDEM RISC default closure criteria.

It should be noted that Qepi understands a chemical solvent plume is currently being evaluated at the AM General property located immediately adjacent to the west of the Hannover subject site. Due to the limited nature of impacts and the lack of a significant source encountered in soil or groundwater, Qepi does not believe that solvent concentrations located on the subject site are related to solvent impacts encountered at the AM General parcel.

Qepi has utilized the data collected from this investigation along with data collected from prior investigations throughout the subject site to evaluate potential remedial alternatives for soil which are outlined below.

Free Product Recovery

Based on the results of this investigation and results of previously conducted assessments on the subject property and surrounding area, Qepi believes that the initial remedial objective should focus on providing an efficient and effective method to recover the LNAPL petroleum product located in the north/northwestern portion of the subject site extending north and northwest onto the Mother Earth and AM General parcels. A map depicting the extent of free product and the estimated free product plume at the properties is provided as Figure 15.

Both historic gauging results and results of this investigation indicate that several of the monitoring wells located within the above described area have exhibited varying thicknesses of free product, with the most recent gauging event encountering 2.38 feet of free product in

monitoring well MW-327. Based on the identified impacted media, extent and magnitude of COCs, candidate remediation technologies were evaluated to address free product petroleum impacts to groundwater only. Qepi considered the following as potential corrective action alternatives to address free product impacts:

- **Pump and Treat –** An installation of a low maintenance pump and treat system consisting of a series of recovery and extraction wells located throughout the area of impact could be designed to remove free product petroleum within the first encountered groundwater saturated zone. Recovered fluids would be transferred from the wells via piping to an oil/water separator unit located in an onsite system. Water and separated oil would then be transferred to separate holding tanks. Water would be further treated and then discharged directly to the surface via PVC piping. Collected oil would be transferred to an onsite storage tank for disposal or recycling, if applicable. Potential drawbacks would include the need to handle, treat and discharge large volumes of water based on the highly permeable characteristics of the aquifer.
- **Slurry Wall –** An installation of a low permeability slurry wall would potentially inhibit free product from migrating from the subject property and the neighboring properties to Bowman Creek and further downstream. While generally costly, slurry walls are an effective technology to eliminate further impacts from an off-site source. A slurry wall alone would not reduce or eliminate existing on-site impacts, and would therefore have to be coupled with another remediation technology to address the free product at the site. Additionally, due to the nature of funding for this proposed remediation, remediation will be conducted for all parcels together, eliminating the need to segregate impacts.
- **Oil Recovery Well System –** A series of wells spaced approximately 50 feet apart could potentially recover a larger volume of free product over a larger area than a pump and treat system. The wells would be equipped with a pneumatic skimmer/pump assembly with a hydrophobic filter that theoretically would not recover groundwater. A well-based oil recovery system would also have the benefit of not relying on groundwater drawdown, therefore lessening the negative impact on saturated soils and the amount of groundwater requiring treatment and discharge. Injections of a surfactant to enhance oil recovery may be useful if recovery proves to be slower than is desired.

After evaluation of these remedial alternatives, Qepi believes that an oil recovery well system encompassing the entire estimated free product plume area would be the most effective method of recovering free product. After review of this subsurface investigation has been completed, Qepi anticipates coordination with IDEM and the IBP to further discuss this remedial alternative.

Qepi will conduct a pilot test of the proposed system after discussing costs and details of the pilot testing with IDEM and the IBP. It is anticipated that pilot testing would include a recovery well with oil skimming pump and observation points to measure any drawdown of the LNAPL layer. Once the test has established the oil recovery rate, injections of a surfactant will take place upgradient of the recovery well so that benefits of the injections can be evaluated against their

cost. Qepi will provide, after proper review of the pilot test data is complete, an oil recovery system design plan to IDEM, detailing system design specifications. A cost estimate to conduct the remedial actions will be provided in the system design plan.

It should be noted that Qepi did not consider potential corrective action alternatives to address impacts to soil or dissolved impacts to groundwater at this time. These potential impacts will be addressed once free product has been significantly reduced at the site.

The findings and conclusions made part of this project report are not to be construed as legal advice. No environmental investigation can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in connections with a property. Furthermore, there is a point at which the cost of information obtained or the time required to gather it outweighs the usefulness of the information and, in fact, may be a material detriment to the orderly completion of transactions.

Qepi is not responsible for the identification of recognized environmental conditions that may be present outside the evaluated area. Qepi is not responsible for unrecorded data pertaining to the property, nor are we responsible for independent conclusions or opinions made by others of this report. Qepi makes no warranties, expressed or implied, as to fitness of this report for any particular purpose.

5.0 Report Disclaimer

This Phase II ESA report was prepared in accordance with generally accepted principles and practices in the environmental consulting field. Conclusions and recommendations expressed herein were developed from site evaluation and limited research, and we are not responsible for unrecorded data pertaining to this site. Qepi makes no warranties, expressed or implied, as to the fitness or merchantability of said property for any particular purpose, and we are not responsible for independent conclusions or opinions made by others based on this report.

This investigation was limited to the areas specified on the figures of this report. Qepi is not responsible for the identification of recognized environmental conditions that may be present outside this evaluated area, chemical parameters other than those specified by the City and IDEM, or at depths greater than that to which soil borings were advanced.

Any opinions and/or recommendations presented apply to site conditions existing at the time of performance of services. We are unable to report on or accurately predict events, which may impact the site, following performance of the described services, whether occurring naturally or caused by external forces. We assume no responsibility for conditions we are not authorized to investigate, or conditions not generally recognized as predictable at the time services are performed. Qepi makes no recommendations in regards to the sale, purchase, lease, construction, or other improvements on the subject property.

We are not responsible for changes in applicable regulatory standards, practices, or regulations following performance of services.

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7.0 Signature Page

This Phase II Environmental Site Assessment was prepared by Mr. Nivas R. Vijay, Project Manager, and reviewed by Mr. Brent A. Dayharsh, Director of Technical Services.

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